Methods of Payment
Financial Reporting Requiremen
Financial Reporting Forms

ANALYSIS OF SEX DIFFERENTIALS AMONG PH.D.-HOLDING BIOSCIENTISTS:

SALARY, ACADEMIC RANK, AND PREDOCTORAL AWARDS

This memorandum examines data maintained by the Division of Resources Analysis for significant differences, which might imply categorical sex discrimination, between male and female bioscientists at the doctoral level. The criteria analyzed are salary, academic rank, and predoctoral awards. To the extent possible, the data are presented so as to discount differing demographic characteristics of the male and female bioscientist pools. Most of the data used are derived from the 1973 Survey of Doctoral Scientists and Engineers conducted by the National Research Council and sponsored by the National Institutes of Health and the National Science Foundation. Further analyses on this topic will be developed when additional data become available.

This report was prepared by *Mr. George E. Bowden, III*, of the Manpower Analysis Branch, Division of Resources Analysis, under the supervision of *Mr. William L. Copeland* and *Dr. Robert R. Trumble*. Assisting in the preparation of the report were *Mrs. Dorothy F.* "
Mr. F. William Dommel, Jr., and *Mrs. Jean Anne I*

The purpose of this memorandum is to bring data maintained by the Division of Resources Analysis to bear upon one question. To what extent does discrimination[1] by sex, with regard to human resources, prevail in the biological sciences?

The question is of considerable moment to the future evaluation of manpower resources for biomedical research. About 13 percent of Ph.D.—holding scientists employed in biomedical science work are women, implying the under-utilization of the potential for biomedical research of a large segment of our population. Excellence in health research, progress toward the ultimate victories over human diseases and disabilities, comes from the application of the best available human talent. Discrimination on the basis of individual capacities and performances is essential to a process of selection and development whereby high-potential individuals are identified, trained, and employed in research. Discrimination on a categorical basis such as sex, unrelated to potential for biomedical research, restrains the development of human resources and limits the improvement of the Nation's health.

Because the bulk of the data available[2] is concerned with doctorate level bioscientists, the report will only consider this segment of the pool of bioscientists. However, it should be noted that this group only accounts for 15.5 percent of the women employed as biological scientists as compared with 42 percent of the men.[3] The difference suggests a portion of the problem underlying that explored in this report. In the course of this report, occupationally related differences between the sexes will be examined in terms of three variables or criteria: salary, academic rank, and pre-doctoral fellowships.

---

[1] "discrimination...the act, practice, or an instance of discriminating categorically rather than individually" *Webster's Seventh New Collegiate Dictionary.*

[2] The following are the major data sources for the report. (1) *Survey of Doctoral Scientists and Engineers* (SDSE). This survey, based on a large (≈ 20 percent) sample of the universe of doctoral scientists and engineers, furnishes information on a broad spectrum of employment characteristics such as salary, type of employer, primary work activity, etc. (2) *Earned Doctorate Survey* (EDS). The annual survey of all doctorate recipients, which in some form dates back to 1920 data on a variety of subjects including source of gr postgraduate plans, and time lapse from baccalaurea (3) *Survey of Graduate Science Student Support* (SGSS contains information on level and field of study, and s for all graduate students enrolled in science departmer granting institutions. Although the survey provide data on graduate enrollment, it is of questionable

For example, the bulk of Ph.D.'s awarded to women have awarded recently. Fifty-four percent of women's bioscience Ph. were awarded in the span 1966-1972, while only 40 percent of m bioscience Ph.D.'s were awarded in the same period. This woul expected to have a large impact on the salary differential, i much as it is commonly assumed that those with recent degrees rec lower salaries than those with earlier degrees. Illustration 1 s that salary is indeed affected by recency of degree. Still, consideration apparently has little influence on the salary dif ential between the sexes; for in no year of degree cohort do wom salaries even closely approximate men's. The closest they cor the $2,500 gap in the 1971-72 cohort between the $12,900 mean sa for men and the $10,400 for women.

Illustration 1. Mean Salary 1973, Bioscientists, by Sex and of Doctorate Cohort

Year of Doctorate	Men		Women	
	Numbers	Mean Salary	Numbers	Mean Sal
1935 or earlier	760	$24,200	90	$18,60
1936-40	1,370	25,400	120	19,10
1941-45	1,620	26,100	160	18,40
1946-50	2,640	25,100	250	18,70
1951-55	5,930	24,900	530	18,90
1956-60	6,070	23,000	600	17,10
1961-65	7,300	19,900	870	15,70
1966-70	12,230	16,100	2,070	13,30
1971-72	4,970	12,900	970	10,40
Totals	42,890	$19,900	5,650	$14,70

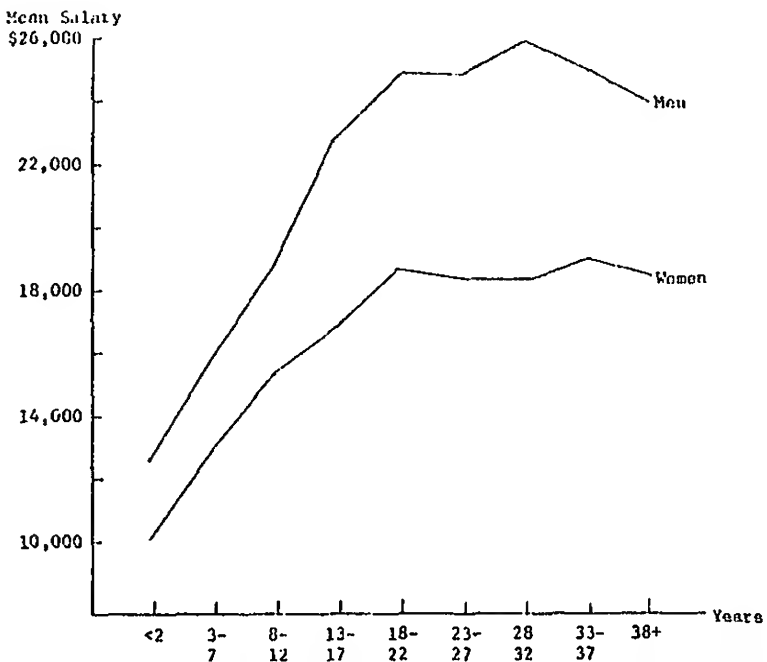
Source: SDSE File.

The number of female Ph.D.'s has been increasing at a more r rate than male Ph.D.'s during the last decade. For instance, in period 1956-1960 there were 10 male graduates for every female. 1971-72, though, there were only 5 males for each female. Cou with the apparent decrease in the disparity between men and wo over the entire reported time span, this could give the impres that the total salary differential is decreasing. However,

A second possible explanation arises from the generally held supposition that few women devote their whole lives to their careers, having to take time out for child bearing and rearing. If this is the case, then one would expect that it would take longer for a woman to achieve comparable pay just because she is dedicating a large chunk of time to her family rather than to her profession. However, indications are that this does not have much impact on explaining the situation. Only three-fourths of women life scientists with Ph.D.'s have ever married[4] (against 95 percent of the men); this partially dilutes the effect those with family responsibilities have on the whole population of women bioscientists.

Furthermore, if this hypothesis were true, its effects would appear when mean salary is graphed against years in the doctoral bioscience manpower pool (i.e., years since receipt of doctorate). As can be seen from Illustration 2, however, the salary curves for both men and women level off at 18-22 years in the pool, and the women level off at a significantly lower plateau than the men. This indicates that women are unlikely to achieve pay comparable to that received by men no matter how long they work. In other words, by the time one has been in the pool for twenty years or so, one has about reached the maximum salary regardless of sex; at that point, women's salaries are only about three-quarters the amount of men's.

Illustration 2. 1973 Mean Salary vs. Years in Doctoral Bioscience Pool



[illegible] for men is $20,500 as compared with [illegible]
a difference of $4,500 which is somewhat less than the $5,20
for all employed bioscientists. Still, the separation between
earnings for the two sexes is quite large, as mean salaries for
still are less than 80 percent of mean salaries for men.

Illustration 3. Mean Salaries, Bioscientists, by Employme
Status and Sex

	Male	Female	Differen
Total, Employed Bioscientists	$19,900	$14,700	$5,200
Full-Time Employed	20,500	16,000	4,500

Source: SDSE File.

None of the considerations that have been examined have suf
to explain the rather large disparity between the salaries of me
the salaries of women. There are of course, other explan
hypotheses that are not testable with currently available data.
one, the time that women devote to the raising of a family us
comes early in their lives, at a time which may be crucial f
career development standpoint. The foundation of a Ph.D.'s c
is commonly laid early in the professional years. Failure to do
imposes a handicap upon one's future advancement. Indeed, it m
that those women who marry but continue their careers throughou
find the dual responsibility of career and family sufficiently bu
some that they cannot devote the necessary time and effort for p
achievement. Nonetheless, the data reviewed here tend to
credence to the hypothesis that categorical sex discriminatio
be a major component of any explanation for the salary gap. Hov
in fairness it should be noted that the biosciences are not u
in this, as can be seen in Illustration 4; women in both the phy
sciences and the social sciences are at a significant disadva
in average salary.

Biological Sciences	$19,000	$14,700	$5,200
Physical Sci. and Eng.	21,200	15,500	6,700
Social Sciences	20,000	15,800	4,200

Source: SDSE File.

II. Academic Rank.

Let us now examine another metric for success: academic rank. Obviously only those bioscientists employed by universities and colleges are subject to this examination. This, however, may help to provide a fairer comparison between the sexes, inasmuch as this sub-pool is somewhat more homogeneous than the whole pool; a substantially higher proportion of male bioscientists than female bioscientists are employed by private industry,[5] where salaries are higher than they are in academia. In addition, the academic rank criterion removes the bias attached to schools where salaries are high.

Illustration 5. Percent Distribution and Mean Salary, Academic Rank of Bioscientists Employed by Four-Year Colleges, Universities, and Medical Schools by Sex

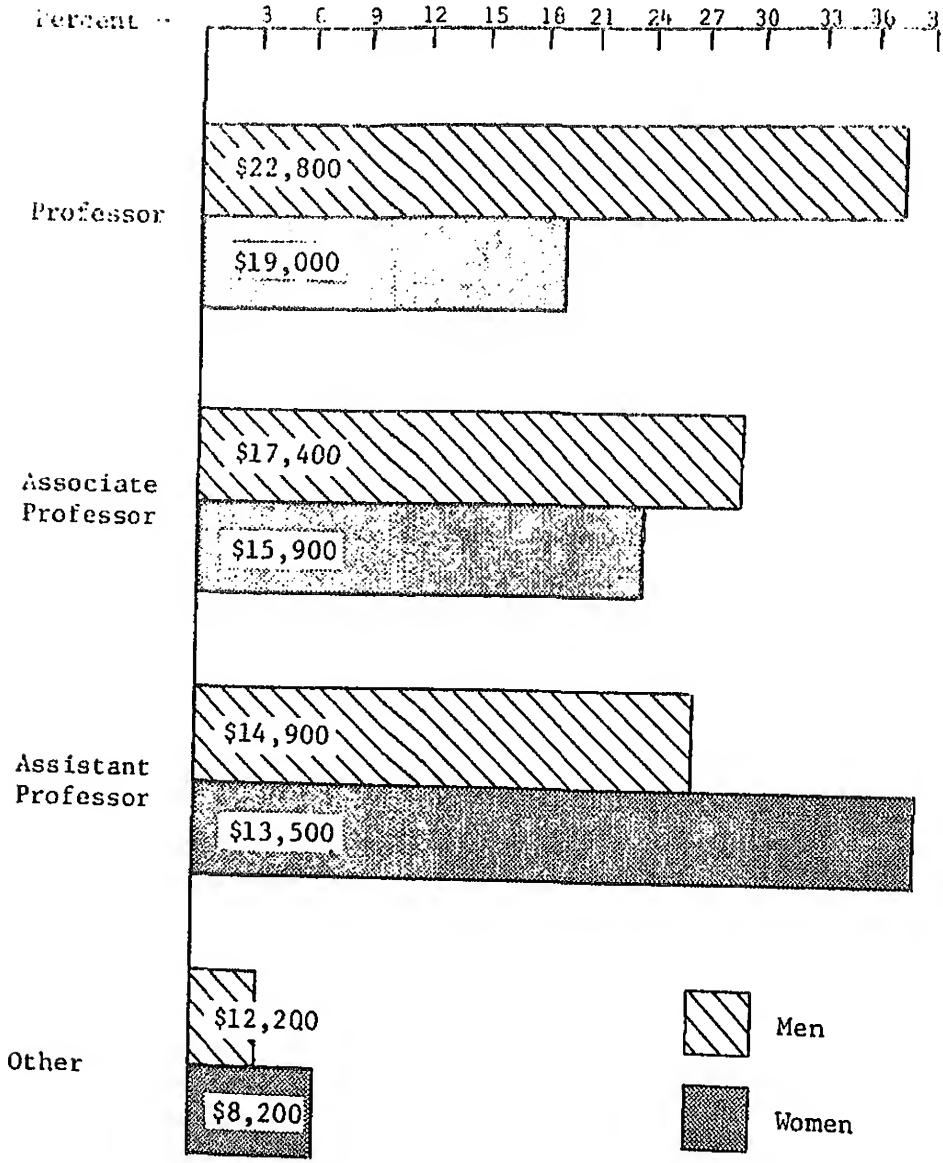
Academic Rank	Men		Women	
	Percent	Mean Salary	Percent	Mean Salary
Total*	100.0	$18,400	100.0	$13,700
Professor	37.5	22,800	19.1	
Associate Professor	29.2	17,400	23	
Assistant Professor	26.5	14,900		
Other	3.5	12,200		
No Report	3.6	-		

*Detail does not add to 100 percent
Source: NAS tables produced for NIH

Illustrations 5 and 6 show
around the rank of assistant profes
the greatest number of men is tha
there are nearly twice as many ma

[5]Four percent of women are empl

Illustration 6. Percent Distribution of Male and Female Bioscientists, by Academic Rank (Dollars = Average Salary)



Source: SDSE File.

tion would seem to be more directly based on years since the doctorate than is salary distribution. Consequently, Illustration 7 has been prepared to explore this by means of a weighted mean academic rank based upon a simple scoring procedure.

Illustration 7. Mean Academic Rank, Doctoral Bioscientists, by Sex and Year of Doctorate Cohort

Year of Doctorate	Men		Women	
	Rank	Salary	Rank	Salary
1950 or earlier	3.9	$23,900	3.5	$17,100
1951-60	3.7	23,800	3.4	17,100
1961-65	3.2	18,500	2.9	15,000
1966-70	2.5	15,100	2.6	12,800
1971-72	2.5	11,900	2.6	9,500

4 = Professor
3 = Associate Professor
2 = Assistant Professor
1 = Instructor

Source: SDSE File.

Indeed, we see that the men who received their degrees prior to 1965 have achieved a higher rank, on average, than the comparable women. However, those women who have received their degrees since 1966 rank slightly higher than the men who received their degrees in the same period. It should be recalled that better than half of the women fall into this category. It seems, then, that women, when their relative deficiency in years in the doctorate pool is accounted for, do nearly as well as men in terms of academic rank. Still, their salaries are not at an equivalent level, which may mean that the near parity in rank is a distribution of titles without substance.[6]

[6]The unequal salary levels could be a reflection of differing distributions of male and female faculty among schools; e.g., proportionately more women than men might be employed at junior colleges and small colleges where salary scales are probably somewhat lower than at major universities. This, however, would raise further questions of possible sex discrimination.

that fellowships and traineeships go to the most promising students

Illustration 8. Percent Distribution, Sources of Support of Full Time Graduate Bioscience Students by Sex, Fall 197

Sources of Support	Men	Women
Total, all Sources	100.0	100.0
Total, Federal	32.2	30.4
NIH	20.2	20.3
NSF	3.8	3.1
Other Federal	8.4	7.0
Total, Non-Federal	48.9	49.4
Schools, State and Local Government	41.6	43.8
Other U.S.	5.2	4.6
Foreign	2.0	1.0
Self, Loans, Family	18.8	20.2

Source: Fall 1973 SGSSS.

Illustration 8 shows that among those enrolled as graduate students in the biosciences in 1973, there is little difference in terms of support.

Illustration 9. NIH Supported 1972, 1973 Doctorates in Life Sciences by Type and Sex, Percent of Total Doctorates in Life Sciences

NIH Support	Men	Women
1972		
Fellowships	9.3	14.6
Traineeships	20.8	33.1
1972		
Fellowships	7.4	10.7
Traineeships	20.0	31.8

Source: Earned Doctorate Survey.

Illustrations 8 and 9 appear to conflict in their measurement of NIH support. There are several distinctions to be made as to what the tables represent. Illustration 8 is a report on the support status in one year of all graduate students in the biosciences, which inevitably includes master's candidates. Illustration 9 is a report by all doctorates in the life sciences (including agriculture) on their support throughout their graduate education. Thus, the two tables are not strictly comparable, though one is certainly led to the conclusion that men have lost any advantage they may once have had in terms of financial awards in graduate school.

IV. Conclusion.

In summation, it seems clear that, on the average, women bioscientists do not approach the salary levels attained by men. While there are many possible explanations for the difference in salary, most centering around the proposition that a woman does not devote as large a portion of her life to her career as does a man, these explanations do not seem sufficient to account for the size of the gap. The conclusion that proffers itself, then, is that substantial sex discrimination in salary exists in the biosciences.

In contrast, the other criteria that we examined, faculty rank and financial awards in graduate school, do not display the wide variance between the sexes that salary does. The younger women do as well as the younger men in terms of academic rank, although their older counterparts do not seem to attain, on average, as high a rank as do the older men. From the available data, there is little if any evidence of sex difference in terms of financial support in graduate school. In fact, a higher proportion of women than men obtain NIH fellowships and traineeships.

In conclusion, it seems that women bioscientists have not yet attained equality with men, particularly in salary. Still, it would appear that the situation is improving, inasmuch as the younger women do as well as men, at least in academic rank and financial awards.